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B26F

(54) Washable floor mats

(57) A washable floor mat (20) having a backing of water-impermeable material, e.g. rubber, and a carpet-like nap or pile on its front surface secured to an intermediate web within the backing, has permanently open small holes (21) punched in the backing by needle-punching using barbed needles having nicks which remove material from the backing during the needle-punching operation.

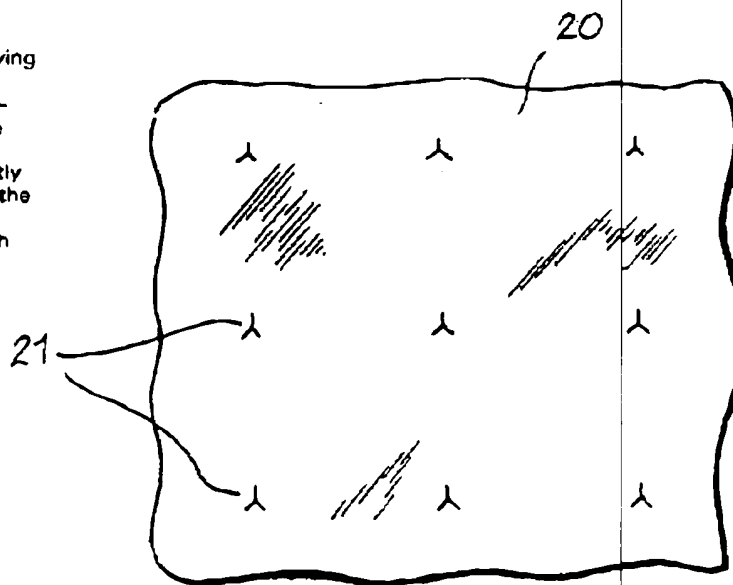
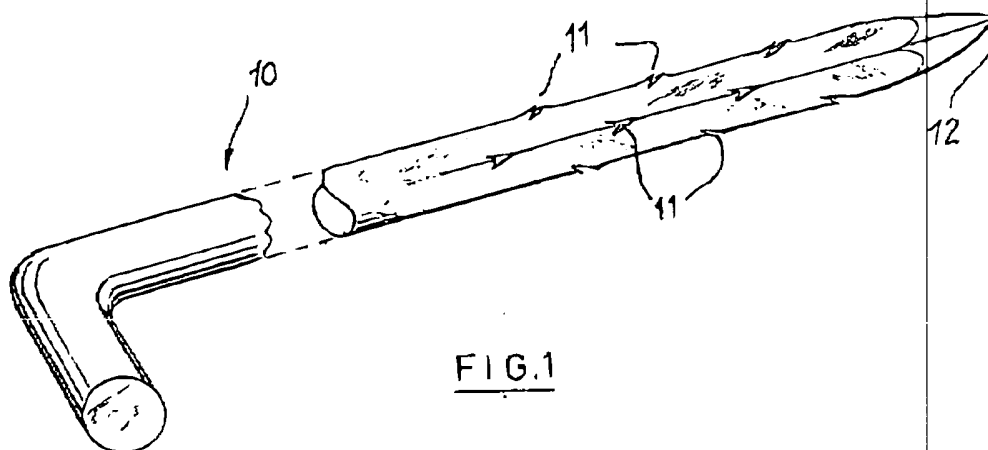
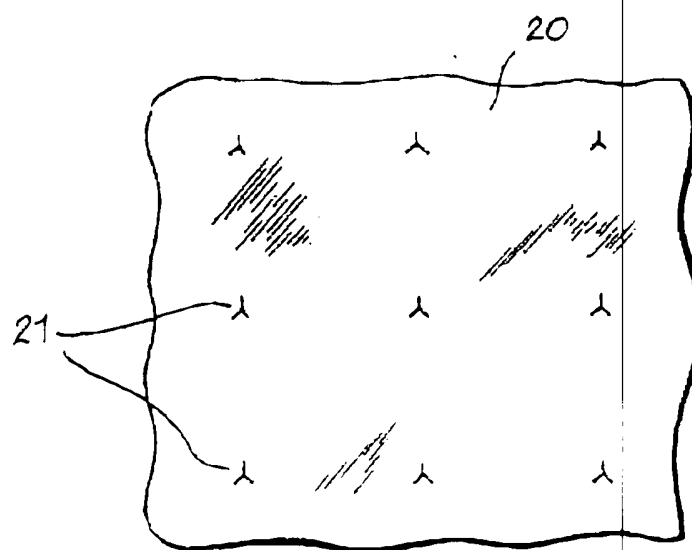


FIG. 2

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FIG. 1FIG. 2

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## SPECIFICATION

## Floor mats

- 5 The present invention relates to dust control mats. 5
- Dust control mats are washable floor mats which are placed on floors in areas where numerous people may walk with dirty or wet shoes and they are intended to absorb the dirt and water shed from those shoes. When they become soiled they are laundered and reused. Such mats conventionally have a rubbery backing and a carpet-like nap or pile on their front surface
- 10 held in position by an intermediate web within the backing. 10
- Careless laundering of these mats has in the past led to them being damaged during laundering owing to "hydrobursts", that is to say bursting of the backing under pressure from water trapped inside the nap or pile.
- 15 It has been proposed on several occasions for 7 years or more to cure such a defect by perforating the mat so as to allow water to escape through the resulting holes or perforations during the laundering process and thus improve hydrotreating. 15
- In GB Patent No. 2098861B a mat of this type is proposed in which the backing is formed with through perforations which are closed against the passage of water through the backing in normal use but which open to permit passage of liquid through them when the mat is subjected
- 20 in the course of mechanical treatment to a pressure difference across the backing. The perforations in question are required to be liquid-tight in normal use of the mat, and they are described as being simple pressure-relief valves (formed by needle-punching using Y- or V-form needles) which are normally closed but can open during mechanical or suction treatment of the covering. 20
- Valve-like perforations of this type must be formed without the removal of any material from the backing if they are to have any chance of remaining liquid-tight when the mat is resting on a
- 25 floor in use. Even so, mats allegedly in accordance with the patent have been found to leak water to the floor underneath when trodden on to the extent conventional in normal use on a wet day. Moreover, such mats have also suffered hydroburst damage during careless laundering because of the size of the perforations which do not permit sufficient drainage of water during
- 30 laundering. It has also been found that the hydroextraction performance of such a mat, needle-punched with unblemished needles of circular cross-section, is little if any better than that of an unperforated mat in that almost as much water remains trapped in the mat after a standard extraction cycle as in an unperforated mat. 30
- The present invention provides a perforated mat which is less liable to hydroburst damage and
- 35 has improved hydroextraction performance as compared with an unperforated mat. 35
- According to the present invention there is provided a process for treating a washable floor mat having a backing of water-impermeable material and a carpetlike nap or pile on its front surface secured to an intermediate web within the backing, comprising perforating the backing
- 40 by needle-punching using one or more barbed needles so that material is removed from the backing during the needle-punching to form permanently open holes in the mat. 40
- Mats according to the present invention have a backing dotted with many small holes usually of a diameter less than 2 mm. These are permanently open to the extent that they allow light to be visible through the backing when the backing is in an unstretch state, and the mats are thus not liquid-tight in normal use. Nevertheless the holes are in general small enough when barbed
- 45 needles of appropriate size are used to allow the mat to retain some water, before water is pressed through them onto the floor beneath by the foot pressure of people walking on the mat in normal use (e.g. breakthrough points of 200-300 cm/square metre or more). More importantly, because the holes are not liquid-tight and do not act as normally-closed pressure-relief valves, they offer less resistance to the flow of water through them during laundering of the
- 50 mats. Accordingly, the mats are less subject to hydrobursts during careless laundering than mats having normally closed, liquid-tight valves and possess superior hydroextraction properties compared to such mats having a comparable hole density. 50
- The holes may be arranged in any convenient pattern and with an appropriate spacing. Reducing the spacing between holes decreases the risk of hydroburst damage but requires more
- 55 needles and/or more rapid reciprocation and thus increases costs, whereas reducing the number of holes decreases the hydroextraction benefits. Preferred mats strike an optimum balance between the factors. Mats with as many as 1.3 to 4 or more holes per square inch (2000 per m<sup>2</sup>-6400 per m<sup>2</sup>) may be appropriate in some cases, but more often it is preferred to provide from about 0.1 to 1.3 holes per square inch (150-2000 per m<sup>2</sup>), e.g. holes at an average
- 60 spacing of 2 inches (5 cm). 60
- Needles to form the small holes by needle-punching may be standard needles of any conventional cross-section, for example triangular, modified by the provision of one or more nicks, e.g. in their edges. Needles of this type are known in the textile industry for the manufacture of
- needles for the manufacture of nonwovens. These needles have a cross-section which is generally triangular with a small notch or nick in one of the edges. These needles are used to punch holes in the backing of the mats.

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- produce the required small holes. The needles may for example have diameters of about 0.5 to 2 mm or more, preferably 0.75–1.5 mm, and point lengths (penetration distances) of 2.5 mm to 25 mm or more. They may be used in standard needle punching machines or simpler machines may be devised in which a bank, for example a single transverse row, of needles of a suitable spacing, e.g. 5 cm, is held on a bar and reciprocates at a predetermined rate, e.g. every 0.5 to 1 second, vertically or at an angle to the vertical into and out of the backing of a mat positioned horizontally or at an angle to the horizontal beneath the bar. The needles should penetrate the backing from the back of the mat in order to avoid entanglement with and damage to the nap or pile on the front surface of the mat. In another alternative the barbed needles could be mounted on a rotatable drum.
- The pattern formed by the holes may be square, rectangular, staggered, circular, random or of special shape, as desired. Each individual hole will have a characteristic appearance depending on the shape of the barbed needle.
- The nature and composition of the carpetlike pile or nap, the intermediate web and the backing material may be those that are already known or conventional in this field. Further details may be found for example in GB Patents 2,115,893 and 2,098,861 and US Patent 3,956,551. As has been known for 8–10 years or more, nylon pile or nap requires a thicker intermediate tissue to give optimum resilience and prevent the pile being permanently deformed when the backing is applied. Web thicknesses of up to 1 mm or more, e.g. 1.2, 1.5 or 1.8 mm, may be used for the intermediate web with weights of up to 100 g/m<sup>2</sup> or more, e.g. 120, 150 or 180 g/m<sup>2</sup>. The rubbery backing may be ordinary rubber or ABS or like rubbery plastics material. The mat may be produced in a conventional manner, by securing the nap or pile to the intermediate web and then coating the back of the intermediate web with the backing material, and the needle punching can be performed during manufacture or subsequently. The holes do not have fabric or pile passing through them.
- Although the above description has been expressed in terms of forming holes in dust control mats, barbed needles can also be used in accordance with a broad form of the present invention to form holes in all types of impermeable rubber or plastics sheets by means of needle punching. Needle punching using barbed needles has advantages over drilling, punching, use of hot needles and other hole-making methods in that it is readily possible in this way to form tiny (microscopic) permanent holes.
- The invention is illustrated by the accompanying drawings in which  
 Figure 1 is a view of a barbed needle suitable for use in producing the holes, and  
 Figure 2 is a view from the back of a portion of a floor mat according to the invention showing a pattern of holes.
- Referring to the drawing a metal needle 10 has a triangular cross-section with three nicks 11 in each of the three edges the nicks being staggered from one another along the length of the needle. Towards its tip 12 the needle tapers through a rounded cross-section to a point. Its length from tip 12 to far end of the triangular region (maximum depth of penetration) is 2.5 cm and the diameter of the circle circumscribing the triangular cross-section is 1.25 mm.
- Such a needle was used to make holes 21 in a washable floor mat 20 having a backing 22 of rubber and a fabric pile on its front surface (not shown) secured to an intermediate web within the backing. The holes are arranged in a square pattern at a spacing of 5 cm and each hole has a characteristic 3-pointed star appearance.
- The advantages of the invention are illustrated by the following Example.
- Example*
- Samples of a dust control mat having a rubber backing and a high-twist nylon pile on its front surface were tested for hydroextraction performance. One such sample (A) was left unperforated, a second sample (B) was perforated with a pin in a square pattern with a spacing of 5 cms (equivalent to a density of 400 per m<sup>2</sup>) to provide perforations of the type specified in GB Patent 2,098,861, a third sample (C) was perforated with a barbed needle as described with reference to Fig. 1 to produce a mat according to the present invention in an identical pattern (hole density 400 per m<sup>2</sup>) and a fourth sample (D) was perforated with the same barbed needle but in a square pattern with a spacing of 1.25 cm (hole density 6400 per m<sup>2</sup>).
- Each sample was subjected to repeated hydroextraction tests in an Electrolux FLE 120 washing machine (Electrolux is a Registered Trade Mark) using a 3-minute cold rinse to wet the samples and a 5-minute extraction. The weight of water remaining in the sample after each test was measured. The results obtained are shown in the Table:

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5 Sample	Number of Tests	Median weight of water retained g/m <sup>2</sup>	Mean weight of water retained g/m <sup>2</sup>	5
A	23	320	345	
B	60	330	330	
C	46	280	295	
10 D	48	250	260	10

These results show that both C and D give improved results compared with A and B even though C has no more holes than B. By contrast B is not markedly better than A even though it has perforations. D has a lower breakthrough point (minimum amount of water present on the mat which will cause water to pass through when the mat is walked on) than C and requires greater expenditure in manufacture because of the extra number of needles and holes. 15

#### CLAIMS

- 20 1. A process for treating a washable floor mat having a backing of water-impermeable material and a carpet-like nap or pile on its front surface secured to an intermediate web within the backing, comprising perforating the backing by needle-punching using one or more barbed needles so that material is removed from the backing during the needle-punching to form permanently open holes in the mat. 20
- 25 2. A process according to claim 1, wherein barbed needles having a triangular, cross-section with 2 to 4 nicks in each edge are used. 25
3. A process according to claim 1 or 2, wherein barbed needles having a maximum diameter of 0.75 to 1.5mm in the portion penetrating the backing are used.
4. A process according to any of claims 1 to 3, wherein the needle-punching with the 30 barbed needles is carried out to provide from 150 to 2000 holes per square metre. 30
5. A process according to any of claims 1 to 4, wherein the needle-punching is performed using a bank of spaced-apart barbed needles simultaneously penetrating the backing from the rear surface of the mat.
6. A process according to claim 1 and substantially as hereinbefore described.
- 35 7. A washable floor mat having a backing of water-impermeable rubbery material and a carpet-like nap or pile on its front surface secured to an intermediate web, characterised in that it has a plurality of permanently open holes punched in its backing of a size less than 2mm by means of a barbed needle. 35